MECHANICALLY ACTUATED AIRTIGHT DEVICE

FIELD OF THE INVENTION

The present invention relates to a mechanically actuated airtight device which is essentially used as a chassis for a wafer carrier and quickly provides airtight and de-airtight functions in response to the unlocking and locking movements of a unlock/lock mechanism.

BACKGROUND OF INVENTION

During the process of manufacturing a wafer, an inert gas (e.g., nitrogen) filling machine is required to fill inert gas into a wafer carrier. The conventional chassis of a wafer carrier produced by two of the largest manufacturers of 200 mm-diameter wafer in the world, Asysyt™ and Empak™, is provided with holes, but it still could not contain an airtight design.

US Patent 4,995,430 by Bonora et al. discloses a latch mechanism which is disposed on the box door and is used for engage the box door with the box. However, the latch mechanism does not have any airtight function.

To achieve an airtight effect, a sealing element (e.g., O-ring) must be utilized in the engaging interface between the wafer carrier case and the chassis, and further an engaging force is applied to the interface (e.g., by screws) to eliminate gaps in the interface and to achieve the airtight effect. However, since the airtight effect in prior art is primary for maintaining a long term and stable airtight condition, the way of engaging and the condition typically cannot be varied. In addition, the prior art only provides a static and constant airtight effect, which does not meet those requirements associated with different airtight levels

under both of unlock/lock conditions of the wafer carrier. Further, prior art cannot synchronically and quickly provide the airtight and de-airtight functions, and thus does not satisfy the requirements in the processes of filling the inert gas into the wafer carrier.

Therefore, when the wafer carrier is sealed, it should obtain a better airtight; on the other hand, when the wafer carrier is opened, it should balance the differential pressure between inside and outside of the wafer carrier so as to easily separate the chassis from the carrier, and hence break the airtight quickly. Thus, a airtight device is needed to quickly provide airtight and de-airtight functions corresponding to opening and closing of a unlock/lock mechanism of the wafer carrier.

SUMMARY OF INVENTION

Accordingly, an objective of the invention is to provide a mechanically actuated airtight device which, on one hand, when the wafer carrier is sealed, should obtain a better airtight; on the other hand, when the wafer carrier is opened, should balance the differential pressure between inside and outside of the wafer carrier so as to easily separate the chassis from the carrier, and hence break the airtight quickly.

Another objective of the invention is to provide a mechanically actuated airtight device wherein the level of the airtight condition can be adjusted as required.

Still another objective of the invention is to provide a mechanically actuated airtight device which meets requirements of filling inert gas into a wafer carrier with a inert gas filling machine in a process of manufacturing a wafer carrier.

According to the present invention, a mechanically actuated airtight device comprises a cover having an upper face and a lower face, and

forming with at least one hole therethrough; at least one sealing gasket being positioned above the hole of the cover, the sealing gasket having a base in a form of wedged ramp and the base further forming a through opening; at least one linked plate having an upper face and a lower face, the lower face being provided with a protuberance on one side and the upper face being provided with at least one wedged ramp at the side corresponding to the protuberance, the wedged ramp having a slope equal to that of the wedged ramp of the base, such that at least one of the wedged ramp of the upper face of at least one of the linked plate mates with the wedged ramp of the lower face of at least one of the linked plate; and a driving wheel having an upper face and a lower face, the upper face being provided with a guiding groove to allow the protuberance of the linked plate move along the guiding groove.

From the description of the preferred embodiments and with reference to the accompanying drawings, the structure and features of the subject invention will be better understood by those skilled in the art.

BRIEF DESCRIPTION OF FIGURES

Fig. 1 is a perspective view of a mechanically actuated airtight device in accordance with the present invention, which is positioned on a chassis of a wafer carrier;

Fig. 2 is a partial exploded perspective view of a mechanically actuated airtight device in accordance with the present invention;

Fig. 3 is another partial exploded perspective view of the mechanically actuated airtight device in accordance with the present invention;

Fig. 4A is a schematic view, showing a de-airtight condition of the mechanically actuated airtight device in accordance with the present

invention;

Fig. 4B is a schematic view, showing an airtight condition of the mechanically actuated airtight device in accordance with the present invention;

Fig. 5A is a cross-sectional view taken along the line 5A-5A of Fig. 4A; and

Fig. 5B is a cross-sectional view taken along the line 5B-5B of Fig. 4B.

not shown

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to Fig. 1, the mechanically actuated airtight device 1 in accordance with the present invention essentially is used as a chassis for a wafer carrier 3, and is engaged with a cover 2 of the wafer carrier 3 to seal the wafer carrier 3 airtight.

Fig. 2 and 3 are perspective views of the present mechanically actuated airtight device 1. As shown in figures, the mechanically actuated airtight device 1 in sequence comprises a cover 11, a sealing gasket 12, an unlock/lock mechanism consisted of two linked plates 13, 14 and a driving wheel 15, and a bottom 16. The cover 11 is substantially flat and rectangular, and has an upper face 111 and a lower face 112. Adjacent to one corner of the cover 11 is a base 114 formed and protruded from the lower face 112. The base 114 forms centrally a hole 113 passing through the upper face 111 and the lower face 112 (as seen in Figs. 5A, 5B). A stem 115 is extended from the lower face 112 centrally. The lower face 112 is further formed with several threaded holes 116. Further, the cover 11 defines a slot 117 on ends of its opposed sidewalls, respectively.

The sealing gasket 12 is generally cylindrical and has an upper face

121 and a lower face 122. The upper face 121 forms with a recess conformed to the base 114 so as to fit the sealing gasket 12 onto the base 114 of the cover 11. The lower face 122 is in the form of wedged ramp and provides a rim 123 thereon around the central axle of the sealing gasket 12. The sealing gasket 12 further provides a through opening 124 at its center. Thus, when the sealing gasket 12 fits onto the base 114 of the cover 11, the opening 124 will be aligned with the hole 113 of cover 11.

The first linked plate 13 and the second linked plate 14 both are substantially T-shaped, each having an upper face 131, 141, an lower face 132, 142, and a lug 133, 143. The first linked plate 13 and the second linked plate 14 are opposite with respect to the stem 115 of the cover 11, and thus the lugs 133, 143 located opposite on the lower face 112 of the cover 11. Fixed ends 135, 136, 145, 146 are extended from both ends of both the first linked plate 13 and the second linked plate 14, and further, a wedged ramp 137 is formed on the upper face 131 of the end of the first linked plate 13. The wedged ramp 137 has a slope same as that of the wedged ramp of the lower face 122 of the sealing gasket 12 such that the wedged ramp 137 of the first linked plate 13 conforms to the rim 123 of the lower face 122. It should be noted that one of the wedged ramp 137 of the first linked plate 13 and the wedged ramp of the lower face 122 of the sealing gasket 12 is made of an elastomeric material, such as silicone.

The driving wheel 15 has an upper face 151 and a lower face 152, wherein the upper face 151 is formed with an upper guiding groove 153 and a plurality of stops 154. The driving wheel 15 abuts the lugs 133, 143 of the first linked plate 13 and the second linked plate 14 such that the protuberances 134, 144 of the first linked plate 13 and the second

linked plate 14 can move along the upper guiding groove 153 and be limited by the stop 154. The lower face 152 also provides a lower guiding groove 155. The wheel 15 defines a central bore 156 at its center to allow the wheel 15 positioned on the stem 115 of the cover 11. The driving wheel 15 further defines two opposed insert holes 157, 157 on the lower face 152.

The bottom 16 has a profile of flat rectangular as that of the cover 11, and has an upper face 161, a lower face 162. A circular rail 163 is positioned around the center of the face 161 of the bottom 16 to engage with the lower guiding groove 155 of the lower face 152 of the driving wheel 15. A pair of arcuate holes 164 are formed therearound with respect to the center of the bottom 16, and a plurality of threaded holes 165 are drilled on the face 161 of the bottom 16 and corresponded to the holes 116 of the cover 11, which allows screws (not shown) to extend through the threaded holes 116, 165 and engage the cover 11 with the bottom 16. Thus, the present invention mechanically actuated airtight device 1 is completed.

A unlock/lock mechanism is consisted of the first linked plate 13, the second linked plate 14, and the driving wheel 15. Referring to Figs. 3, 4A, 4B, 5A, 5B, in which the operation of the mechanically actuated airtight device is depicted. Figs. 4A, 5A show respectively a schematic view of the unlock/lock mechanism. As shown, the wedged ramp 135 of the first linked plate 13 is disengaged with the wedged ramp 122 of the sealing gasket 12 so that the hole 113 is opened. As seen in Fig. 3, when the locking is required, the user may insert, manually or mechanically, a knob 17 wherein a pair of pins 171 extend individually through the arcuate holes 164 of the bottom 16 and into the insert hole 157 of the lower face 152 of the driving wheel 15. Then, turning the

knob 17 will cause a torsion to rotate the driving wheel 15 which in turn moves the first linked plate 13 and the second linked plate 14 bilaterally until the first linked plate 13 and the second linked plate 14 are limited by the stop 154 of the driving wheel 15 and the driving wheel 15 reaches its deadpoint. As seen in Figs. 4B, 5B, the unlock/lock mechanism is in the locking condition, the wedged ramp 135 of the first linked plate 13 is engaged with the rim 123 on the wedged ramp of the gasket 12 tightly due to the movement of the linked plates 13, 14, such that the hole 113 is sealed and the fixed ends 135, 136, 145, 146 of the first and second linked plates 13, 14 extend outwardly through two pairs of slots 117 in the opposite sidewalls of the cover 11. Therefore, the mechanically actuated airtight device 1 is engaged with the case 2 of the wafer carrier 3 to achieve an airtight of the wafer carrier 3.

The airtight level according to the invention can be varied, as required, by adjusting the slope of the wedged ramps or engaging area of the sealing gasket. Moreover, the invention should not be restricted to forgoing structures, it may make other variations, such as the number of the holes, the linked plates may be more than those.

Although the present invention has been described with respect to the preferred embodiments thereof, various changes and applications can be made by those skilled in the art without departing from the technical concepts of the present invention. The present invention is not limited to the particular details as described in the preferred embodiments. Therefore, it is intended that all such changes of certain features of the preferred embodiments which do not alter the overall basic functions and the concepts of the present invention are within the scope defined in the appended claims.